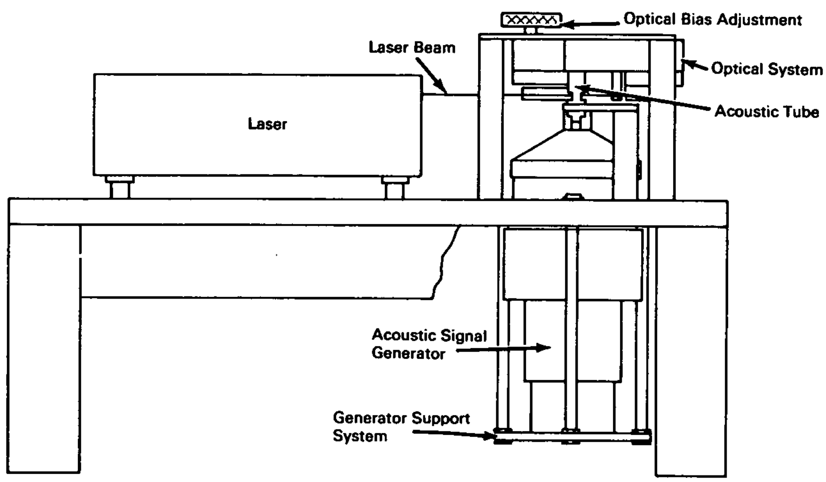
NASA TECH BRIEF

System Enables More Complete Calibrations of Dynamic-Pressure Transducers



The problem:

To devise a system for absolute pressure calibration of high-intensity, wide frequency-response transducers used to monitor acoustic or aerodynamic pressure fields. The system must enable calibration of the phase characteristics as well as the pressure sensitivities of the transducers. Conventional calibration systems used for such transducers seldom provide information about the phase characteristics of the transducers. In experimental acoustic or aerodynamic pressure-field studies, where the signal outputs of one or more transducers must be correlated, it is essential that the phase characteristics of the transducers be known.

The solution:

A system incorporating a Michelson interferometer using a helium–neon laser light source and interchangeable acoustic signal generators which produce acoustic waves in an acoustic cavity at pressure amplitudes between 140 and 175 db and frequencies between 0.5 to 40 kc/s.

How it's done:

The Michelson interferometer incorporates the acoustic cavity in one of the two optical beam paths. Density fluctuations in the acoustic cavity, which are associated with the pressure fluctuations of the calibrating acoustic signal, produce a time-varying optical interference pattern. This pattern is monitored with a photodiode detector, which produces an electrical output signal characterizing both the absolute amplitude and phase of the pressure fluctuations in the acoustic cavity. Comparison of this signal with the electrical output signal of a transducer positioned in the cavity enables the sensitivity and phase characteristics of the transducer to be determined.

(continued overleaf)

The acoustic signals are generated by one of three interchangeable units: two horn drivers for frequencies up to 16 kc/s and a St. Clair generator for frequencies above 20 kc/s. The acoustic energy from these generators is propagated into a 0.25-inch-diameter telescopic tube at the end of which a 0.25-inch transducer to be calibrated is positioned. Adjustment of the length of the tube allows longitudinal tuning of the cavity, which produces an increased pressure amplitude at the transducer diaphragm. Because longitudinal pressure gradients will exist in the tube, the laser beam scans the cavity in a transverse direction immediately in front of the transducer diaphragm for minimal calibration error. The system is capable of being operated with air or other gases at atmospheric or reduced pressures.

Note:

Inquiries concerning this innovation may be directed to:

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Patent status:

No patent action is contemplated by NASA.

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